BREED EFFECT ON TENDERNESS OF BEEF ACROSS THE FOUR DIFFERENT AGE CATEGORIES OF THE SOUTH AFRICAN CLASSIFICATION SYSTEM

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Abstract – The objective of the study was to determine the effect of breed on tenderness of beef across the four age groups (A, AB, B and C) of the SA classification system. The study was conducted at a high throughput abattoir in the Eastern Cape, South Africa. A total of 175 cattle comprising of 5 different beef breeds were used in the study. The breeds were randomly selected at lairages. Carcass classes were recorded at the slaughter floor by a trained meat classifier. Meat samples were then harvested from the *Longissimus thoracis et. lumborum* (LTL) muscle for WBSF measurements. It was found that the C- age group had the highest frequency (78.9%). The C2 class, in particular, was the most prevalent class (53.7%) and was dominated by the Simmental breed (37.2%). Tenderness of the Angus C2 class differed (P<0.05) from that of Fleckvieh and Nondescript breeds. It was concluded that tenderness may differ from carcass classes of animals that fall within the same age category depending on breed type.

Key Words – carcass, WBSF, shear force, breed, age

I. INTRODUCTION

According to Muchenje (1) beef is one of the most consumed sources of protein in the world. Thus cattle production is the most significant livestock sub-sector in South Africa and contributes about 25-30% of the total agricultural output per annum (2). However, there is still an increasing demand for meat and meat products in South Africa (3; 4). The local demand for beef in particular still outstrips the local supply, making South Africa a net importer of beef. Despite this, there is also an increasing consumer demand for high quality meat. Meat quality refers to the compositional quality and the palatability factors of meat which describe the desirability of meat for consumers (5; 1). Palatability factors such as colour, aroma, juiciness and tenderness are key indicators of meat quality involved in a satisfied eating experience of a consumer (5; 6). However, tenderness is certainly the most crucial quality attribute perceived by consumers for satisfaction (6). Quality assurance schemes such as classification systems were, therefore, developed to meet consumer demands for high quality meat. The current South African carcass classification system was implemented in 1992 as a necessary tool for the marketing and trading of SA red meat carcasses. Additionally, it was implemented as a result of findings which confirmed changes in the quality attributes as well as physical and nutrient composition of SA beef carcasses due to age and degree of fatness (7). The SA classification system classifies beef carcasses into four age groups which are determined based on the number of erupted incisors (dentition) with classes A (0 incisors), AB (1-2 incisors), B (3-6 incisors) and C (>6 incisors). The system also classifies carcasses based on the amount of subcutaneous fat with classes ranging from 0 (no fat) to 6 (extremely over fat). Age and fat code have been reported as key determinants of the market price, with young animals and fat code 2 fetching high premiums (7). These factors, therefore, increase economic incentives for producing A2 and AB2 class animals. Nonetheless, Strydom (8) argued that the current classification system gives limited description of the quality-related characteristics as it only describes scores and measurements but does not rank for meat quality attributes. Since the implementation of the current classification system, the quality of beef carcass classes across the four different age groups from different breeds has not been evaluated to assess the cogency of the current system in terms of tenderness. Reuter *et al*. (9) reported that tenderness varies among animals, breeds, muscles and cuts. Pflanzer *et al*. (10) further reported that subcutaneous fat in carcasses may influence meat tenderness. Muchenje *et al*. (11) also reported that relationships among meat quality attributes may differ depending on breed. However, breed and subcutaneous fat differences

and their effect on tenderness across carcass classes are not evaluated in the classification system. This may however be difficult to determine in the current SA classification system which does not use instrumental measurements to determine tenderness. The Warner Bratzler Shear Force is, however, the most broadly used method recognized for the best correlation with sensory panel scores for tenderness (12). This study, therefore, seeks to investigate the effect of breed on beef carcass classes across the four different age groups, with the main objective to come up with possible ways to ameliorate the determination of tenderness in the classification system.

II. MATERIALS AND METHODS

The study was conducted at a high throughput abattoir in the Eastern Cape Province of South Africa. Five different beef breeds (Non-descript, Angus, Fleckvieh, Simmental and Bonsmara) were randomly selected at abattoir lairages with 35 animals per breed. Animals were followed through the slaughter to the dressing floor. Each carcass was classified by a trained carcass classifier using the methods stipulated on Government Notice. No. R.863 for the regulations regarding the classification and marking of meat intended for sale in the republic of South Africa.

Carcass classification

The carcasses were classified based on five different characteristics (age, sex, conformation, bruising and fatness). Age was determined using a dentition method depending on the number of erupted incisors with classes A (0 incisors), AB (1-2 incisors), B (3-6 incisors) and C (>6 incisors). Visual appraisal was used to determine the degree of subcutaneous fat (SF) in millimeters (mm) with scores ranging from 0 (No Fat), 1 (SF<1mm), 2(1≤SF≤3), 3(3≤SF≤5), 4(5≤SF≤7) 5(7≤SF≤10), 6(10≤SF). Bruising and conformation were also determined by visual appraisal with scores ranging between (1 slightly damaged - 3 excessively damaged) and (1 very flat - 5 very round) respectively.

Meat sample harvesting and measurements

Meat samples were harvested from the *Longissimus thoracis et. lumborum* (LTL) muscle of each animal. The samples were refrigerated for a period of 7 days at -20°C. After the refrigeration period the samples were thawed at room temperature until completely defrosted and cooked at 72°C for 45 minutes in a pre-heated water bath (model TRH). After cooking, 3 sub-samples of 10 mm core diameter were cored parallel to the grain of the meat from each sample. The samples were cut at an angle perpendicular to the direction of the fiber using the Warner Bratzler cutting device attached to the Instron Universal testing apparatus (model 3344; ref 3344k8158). The apparatus has a cross speed of 400mm/min, one shear in the center of each core and the maximum load (N) was recorded for each batch.

Statistical analysis

The data were analysed using the Statistical Analysis System (13). Frequency procedure (PROC FREQ) was used to determine carcass classes produced per cattle breed. PROC GLM was used to test the effect of breed on tenderness of beef carcasses within a class and The Fishers' least significant difference (LSD) method was used to separate the means for tenderness. Statistical significance was set at 95% where $P<0.05$ was statistically significant.

III. RESULTS AND DISCUSSION

As illustrated in figure 1, the C age group had the highest frequency (78.9%) compared to other age groups. The C2 class in particular was the most prevalent class (53.7%) and was dominated by the Simmental breed (37, 2%) compared to other breeds. These results concur with those reported by Soji *et al*. (15). The C class is associated with animals slaughtered at an older age with more than 6 erupted incisors. SAMIC (14), classifies carcasses within the C-class as being undesirable for the market as they are less tender. Thus, farmers often get low premiums for C-class carcasses. However, they get bonuses for carcasses with fat code 2 which is classified as lean meat and is mostly preferable in the market. Even so, the effect of breed differences is not included in the SA classification system. Since there is an evidence that most farmers in the Eastern Cape send animals in the C-age category for slaughter and thus produce C2 class carcasses. This,

therefore, suggest a need to determine tenderness in the C2 class across different breeds.

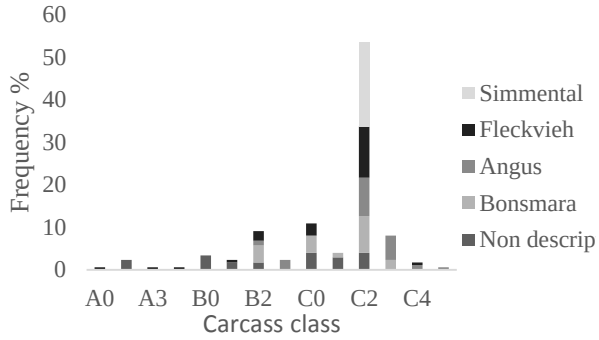

Figure 1: Carcass classes produced per cattle breed

Table one shows results that tenderness of the Angus C2 class differed (P<0.05) from that of Fleckvieh and Nondescript breeds. The classification system assumes that tenderness from carcasses falling within the C age category is the same. However, the current study discovered that meat tenderness from the same muscle differed amongst animals of the same age from different breeds. The Angus and Simmental breeds had the toughest meat (41.54 ± 2.47 and 38.71±1.67, respectively), compared to Non-descript, Fleckvieh and Bonsmara (31.53±3.74; 32.00±2.16 and 36.71±2.55, respectively). These results concur with those reported by Reuter *et al*. (9) stating that tenderness displays wide variation among animals, breeds, muscles and cuts. Muchenje *et al*. (11) also confirmed that meat quality attributes may differ amongst different breeds.

Table 1: Least square means (± SE) of tenderness in C2 class across different breeds

Breed	WBSF LSMEANS
Angus	41.54 ± 2.47^{a}
Bonsmara	$36.71 \pm 2.55^{a, b}$
Fleckvieh	32.00 ± 2.16^{b}
Nondescript	31.53 ± 3.74^{b}
Simmental	38.71 ± 1.67^{ab}

[a, b, c] Means within a column bearing different superscripts differ at P<0.05 and P<0.001; WBSF= Warner Bratzler Shear Force

I.V. CONCLUSION

Even though the SA classification system indicates that meat tenderness decreases with increasing slaughter age WBSF measurements indicate that irrespective of the slaughter age there is a significant breed effect on tenderness of beef carcass classes across the (A, AB, B and C) age categories. The current classification system should, therefore, consider using the WBSF method to determine tenderness across different carcass classes. This could provide quality assurance to consumers for the meat they purchase. It will also ensure farmers that they are not short-changed by flat premiums.

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